



Pre-proposal Briefing:
Technology Development for Exoplanet
Missions (TDEM) Element of the
2014 Strategic Astrophysics Technology (SAT)
Solicitation

Introduction and Overview

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The Strategic Astrophysics Technology (SAT) Program

- Composed of three elements:
 - *Technology Development for Exoplanet Missions (TDEM)*
 - *Technology Development for Cosmic Origins (TCOR)*
 - *Technology Development for Physics of the Cosmos (TPCOS)*
- Three elements are coordinated, but operate independently. Each element has its own Program Officer and funding line (the SR&T line in the associated program—Exoplanet Exploration, Cosmic Origins, Physics of the Cosmos)
 - *TDEM Program Officer: Douglas Hudgins, Douglas.M.Hudgins@nasa.gov*
 - *TCOP Program Officer: Mario Perez, Mario.Perez@nasa.gov*
 - *TPCOS Program Officer: Rita Sambruna, Rita.M.Sambruna@nasa.gov*
- This briefing is specifically for people interested in proposing under the TDEM element of the SAT solicitation. People with questions about the other elements of the program should contact the appropriate program officer.



- The ultimate goal for NASA's Exoplanet Exploration Program envisioned by the Astro2010 Decadal Survey is a "*New Worlds Mission*" that would conduct imaging and spectroscopy of rocky planets in the habitable zones of stars in the Solar neighborhood.
- To meet this challenge, the SAT/TDEM program element solicits investigations that will undertake focused development of technologies that will enable a future strategic New Worlds Mission.
- **In general, the SAT Program designed to address maturation of mid-range "TRL" technologies ($3 < \text{TRL} \leq 6$).**
 - "TRL" denotes the 9-level "Technology Readiness Level" (TRL) classification system NASA uses to rate the readiness of a particular technology for use in a flight mission.
 - TRL definitions are described in detail in the SAT 2014 solicitation and in Appendix E of NASA Procedural Requirement (NPR) 7123.1B (<http://nodis3.gsfc.nasa.gov>; search "7123.1B").



Scope of Program



Areas of technology development solicited under the SAT/TDEM 2014 include:

- **Starlight suppression**
 - *technologies for rejecting scattered starlight to the degree required to image an Earth-like planet around a sun-like star in the Solar neighborhood.*
 - **For coronagraphs**, there is particular interest in demonstrations with obscured and/or segmented apertures suitable for operation with 10-m-class telescopes.
 - **For starshades**, there is particular interest in (a) deployment technologies, (b) shielding concepts and demonstrations, (c) stray light investigation and analyses, (d) systems suitable for operation with 10m-class telescopes.
- **Wavefront sensing and control of scattered starlight**
 - *control algorithms, sensing technology, and deformable mirror technology required to control light paths within coronagraphic systems;*
 - *sensors and algorithms that enable external occulter observatories to move from star to star, and that enable the system to meet and maintain positional stability during science observations.*
- **System performance assessment**
 - *development of high-fidelity, very high density models to infer expected picometer-level on-orbit performance based on nanometer-level ground measurements.*
- Relevant technology development activities involving ground-based astronomical facilities are allowed, but proposals for suborbital programs are not solicited at this time due to budgetary constraints.



Scope of Program



ExoPlanet Exploration Program

- The SAT Program is not intended to support:
 - *basic research into new technologies and initial demonstration of their feasibility (TRL 1-3).*
 - *development of flight hardware (TRL 7-9) for strategic missions.*
- In addition, proposals in the following areas are currently not solicited under SAT/TDEM:
 - *general technology maturation activities without specific application to the requirements of a future exoplanet direct-detection mission;*
 - *development and maintenance of testing facilities and/or tools that substantively reproduce the capabilities of existing ExEP infrastructure.*
 - *Investigations that advance technologies for future strategic missions with goals other than the direct detection of extrasolar planets (e.g. astrometry, high-precision photometry, transit spectroscopy);*
 - *Investigations that advance technologies leading to the development of infrared interferometry as the basis for a future strategic exoplanet direct detection mission.*



Scope of Program



- Proposals in the following areas are currently not solicited under SAT/TDEM 2014 (continued):
 - Investigations that advance technologies for ancillary measurements that do not directly enhance the ability of the system to isolate and analyze the light from an exoplanet (new in SAT/TDEM 2014);*
 - Proposals for the development of technologies for potential competed (e.g., Explorer) exoplanet missions (new in SAT/TDEM 2014);*
 - Development of technologies in the following areas:*

<i>Detector Technology</i>	<i>Telescope Assembly Technology</i>	<i>Mirror Technology (except AO as req. for WFSC)</i>
<i>S/C Pointing Control</i>	<i>Formation Flying Technologies**</i>	<i>S/C Sunshields/Thermal Control</i>
<i>Propulsion Systems</i>	<i>Vibration Isolation Systems</i>	

*** except as allowed under wavefront sensing and control of scattered light development area.*

- Additional caution: Proposers are reminded that all proposals must conform to the formatting requirements set forth in the ROSES 2014 NRA (Section IV) and the 2014 NASA Guidebook for Proposers (Section 2). Proposals found to violate these requirements will be penalized, even to the extent of being declined as non-compliant despite their intrinsic merit review.



Scope of Program



- Additional programmatic limitation under SAT/TDEM 2014
 - NASA has initiated a directed technology development program to advance the technology readiness of a coronagraph instrument for inclusion in a potential WFIRST/AFTA mission.
 - To avoid redundancy, coronagraph technologies that will be substantively advanced under the WFIRST/AFTA technology development are not eligible for funding under the auspices of the SAT Program.
 - Excluded technologies include:
 - *Masks/apodizers for Shaped-pupil, hybrid Lyot, and Phase-Induced Amplitude Apodization Complex Mask (PIAA-CMC) coronagraphs;*
 - *Low-order wavefront sensing and control;*
 - *Data post-processing;*
 - *System-level performance demonstration and modeling of obscured aperture systems.*



Programmatic Information



- Proposals must:

- Provide a convincing case that the maturity of the subject technology falls in the range $3 \leq \text{TRL} < 6$.
- Make a compelling case that that subject technology is important and relevant to one or more of the SAT/TDEM development focus areas.
- Articulate the expected technology advancement
 - *Identify state of technological readiness at beginning*
 - *Identify one or more quantitative milestones that will be achieved over course of proposed development project.*
 - *Identify success criteria for evaluating performance at end of project.*
 - *Provide a detailed schedule for achieving milestones*

Note: The goal of SAT/TDEM program is advancement of key for exoplanet direct detection and characterization technologies to TRL 6-7; however, it is neither required nor expected that this process will be completed within the time frame of a single investigation; the long-term goal(s) of the proposed work may extend beyond proposed period of performance.



Reporting Requirements



- SAT/TDEM investigators will be contacted periodically by a scheduler from the Exoplanet Exploration Program Office to track the progress of their investigation and ensure timely completion of milestones.
- Annual Progress Report
 - A written report, submitted to the SAT/TDEM program officer, detailing the status of the project, progress over the preceding year, and plans for the coming year is required annually.
- Final Report
 - Written report submitted at end of second year detailing project performance against proposed success criteria.
- Formal Documentation of Milestones
 - When work begins, success criteria of a technology demonstration is documented in a whitepaper
 - *Reviewed by independent board appointed by NASA Headquarters, and revised as necessary according to review.*
 - Successful achievement of milestone is documented in a second report that shows success criteria have been met
 - *Also subject to review and verification by independent board.*



4. Summary of Key Information



- Total funding available for new awards: ~\$2.0M in FY16
- Expected number new awards: ~ 3–5
- Expected Period of Performance: 2 or 3 years
- Notices of Intent due: January 23, 2015
- Proposal due date: March 20, 2015
- Planning Date for start of new awards: January 1, 2016
- Website for proposal submission (NSPIRES):
 - <http://nspires.nasaprs.com/>
 - NSPIRES Helpdesk nspires-help@nasaprs.com or (202) 479-9376
- Detailed instructions for proposal preparation
 - NASA 2014 Guidebook for Proposers,
<http://www.hq.nasa.gov/office/procurement/nraguidebook/>
- SAT/TDEM Program Officer: Douglas Hudgins, NASA Headquarters
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